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ABSTRACT

Expectancy models of behavior such as the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM) offer guidelines that aid efforts to facilitate use of new technology. These models remind us that both acceptance of and resistance to technology use are grounded in beliefs and norms regarding the technology. Although TAM is widely used to model user acceptance of technology, it is suggested that the model fails to capture all of the relevant components to technology acceptance in the context of educational organizations. This paper discusses the application of expectancy models to educational institutions and identifies relevant aspects of technology use that are accounted for by TRA. The introduction describes initiatives to support faculty in technology adoption at the University of Arizona. The next section presents TRA and TAM, as well as a survey designed to measure a broad set of potentially relevant beliefs in faculty acceptance of technology. Two pervasive faculty development strategies (i.e., incentives and training) are then considered, using TRA to illuminate the process by which these strategies might affect behavior and using the model to generate new strategies. (Author/MES)

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ED 432 301

# Technological Diffusion within Educational Institutions: Applying the Technology Acceptance Model

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**Abstract.** Expectancy models of behavior such as the Theory of Reasoned Action and the Technology Acceptance Model offer guidelines that aid efforts to facilitate use of new technology. These models remind us that both acceptance of and resistance to technology use are grounded in beliefs and norms regarding the technology. Although the Technology Acceptance Model is widely used to model user acceptance of technology, we suggest that the model fails to capture all of the relevant components to technology acceptance in the context of educational organizations. This paper discusses the application of expectancy models to educational institutions and we identify relevant aspects of technology use that are accounted for by the Theory of Reasoned Action.

## Introduction

When technology offers improvements over existing processes it seems reasonable to expect that the improvements will be readily embraced and incorporated into practice. However, adapting to new technology is rarely this simple; some users will resist change entirely, and even among users who embrace change, the new technology may not be used to its full potential.

Resistance to change is a widely recognized problem in the study of organizations. Resistance is manifested in two behavioral outcomes: either the user fails to incorporate educational technology altogether, or the user fails to use the technology to its full potential (Markus, 1984). The causes of resistance are cognitively based. Because resistance depends partly on the individual's openness to learning and change (Diamond, 1993), we might expect that educators (experts in learning) might be more receptive. However, recent experience with new instructional technology suggests that change in educational organizations is as problematic as change in any other organization.

Five years ago, a deliberate decision was made at the University of Arizona to position a group of early technology adopters as "change agents" on campus. A large interdisciplinary group of faculty recruited by the Provost as a "Faculty Development Team" was assigned the task of preparing the faculty for the use of new technology in the classroom. Specifically, the Team's job was to define training and technology requirements for "student-centered" teaching. Later, this task was handed off to a consortium of instructional support units (the Faculty Development Partnership, formed as a coordinating body for the Library, the Computer Center, the Teaching Center and other units), taking new learning technologies as a defining element of its membership and mission:

> The primary mission of the Faculty Development Partnership is to enhance the undergraduate learning experience at the University of Arizona. Strategically, the Partnership promotes employment of successful teaching models facilitated and strengthened by new learning technologies. Tactically, the Partnership works closely with faculty across the curriculum to create General Education and advanced courses through which students acquire foundational as well as lifelong skills. The Faculty Development Partnership assists campus improvement initiatives, actively supporting ongoing classroom renovations while preparing to implement an Integrated Learning Center (http://www.facpartner.arizona.edu/partners.htm).

Given the specific intention of promoting the use of new technology, and the underlying assumption that new technology will be understood as an enhancement of instruction, the Faculty Development Team and Partnership have undertaken a variety of initiatives to support faculty in technology adoption. At Arizona as at many other educational institutions, two main strategies have been used consistently: incentives and training. These programs have been effective in stimulating some creative projects, but many faculty remain reluctant to consider

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the use of new technology and largely unacquainted with its applications to education. State-of-the-art equipment in newly renovated classrooms remains unused, and rich resources for technology-enhanced learning remain underexploited.

For both practical and theoretical reasons it is important to understand resistance to change within educational organizations, and in particular to understand why educators are reluctant to adopt technology advances. The purpose of this paper is to explore theoretical perspectives on technology adoption and to apply those perspectives to common strategies for promoting change.

## Reasoned Action Models for Technology Acceptance in Education

One theory with potential utility is the Theory of Reasoned Action (Fishbein & Ajzen, 1975), which has recently been elaborated as a Technology Acceptance Model (Davis, Bagozzi, & Warshaw, 1989). The basic idea behind the Theory of Reasoned Action (TRA) is that people take the practical and social consequences of action into account in deciding what to do, building an overall "behavioral intention" as a complex function of value-bearing beliefs about the outcome of the behavior and the beliefs about others' evaluations of the behavior.

TRA predicts acceptance or rejection of certain behaviors from attitude and normative influences on the intent to perform those behaviors. A person's attitude toward the behavior is assumed to be made up of beliefs about its outcomes and evaluations attached to those outcomes. Attitude toward the behavior may be strongly positive or strongly negative; however, attitude toward the behavior is only one potential determinant of the behavioral intention. People also take into account a "subjective norm" made up of beliefs about how others important to them will evaluate the behavior and motivations to comply or not with others' influence. According to TRA, intentions are formed as weighted combinations of attitude and subjective norm, and behavior depends most directly on intention.

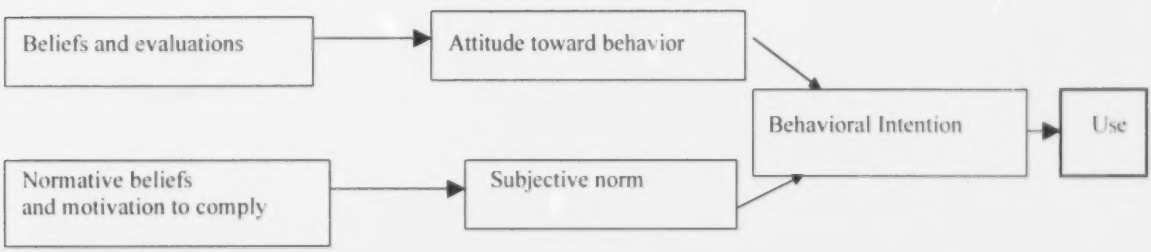


**Figure A:** Theory of Reasoned Action

The Technology Acceptance Model (TAM) is a specialized adaptation of TRA to technology implementation contexts. This model is used to describe the antecedents to technology use (Davis, et al., 1989). TAM suggests that both technology acceptance and technology resistance are forms of reasoned action, and both are in some sense rational for users. A central theoretical assumption is that technological resistance depends on end-user perceptions (that is, on faculty perceptions in the case of educational organizations). TAM describes the relationship between users' beliefs about technology and their "behavioral intentions" (what they actually intend to do with or without the technology).

The specialization of TRA to the technology acceptance context results in two special features of TAM. First, TAM omits the subjective norm component that, in TRA, combines with attitude to determine intention. The development of TAM as an explanatory model led Davis et al. To an empirically-grounded judgment that technology acceptance does not depend on normative beliefs. Second, TAM centers on two specific beliefs that have been shown to influence acceptance of or resistance to technology: perceived usefulness and perceived ease of use. According to TAM, the likelihood of technology use is high for users who believe that it will lead to improved job performance and who believe that it is easy to use, but low for users who either doubt its benefits or perceive it as difficult.

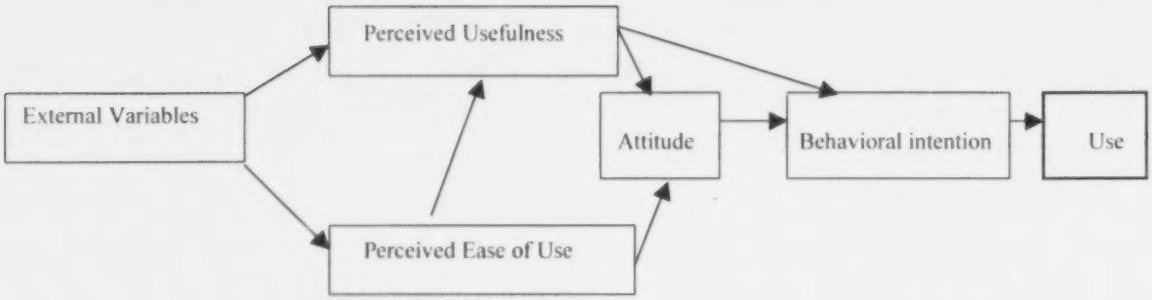


**Figure B:** Technology Acceptance Model

Although specifically tailored to explaining technology acceptance, TAM may or may not adequately represent the factors affecting technology acceptance in educational contexts. Omission of the subjective norm component seems reasonable enough in some organizational contexts (e.g., for-profit corporations). However, in educational contexts, where technology is a potential influence on teacher/student relationships and where individuals identify themselves closely with expert communities of fellow practitioners, it does not seem plausible to assume that the decision to use technology is made without reference to others' approval or disapproval of its use.

Moreover, the two specific beliefs identified by Davis et al. do not offer a straightforward fit with the practical circumstances of faculty workload. At a minimum, the underlying belief set needs expansion to take account of the common faculty problem of balancing investment of time between two or more budgeted activities (teaching, research, and other duties). While faculty undoubtedly consider the impact on the quality of teaching in deciding whether to adopt new technology, they also consider how investment in teaching improvement affects the overall balance of success they might have in teaching and research. Particularly in Research I universities like Arizona, the rewards for improved teaching are thought to be much less certain and much less tangible than the rewards gained from conducting research.

In the tradition of theoretical and practical research following from TRA, the underlying belief set and the weighting applied to various components is generated empirically. Because we doubt the generalizability of TAM to educational organizations, our own attempts to model faculty acceptance of technology include measurement of a much broader set of potentially relevant beliefs, including normative beliefs, as shown in the survey below (http://emma.comm.arizona.edu/techuse.html).

Strongly Agree = SA Agree = A Neither Agree nor Disagree = N Disagree = D Strongly Disagree = SD

| | | | | | |
|---|---|---|---|---|---|
| Learning to use WEB based instruction would be difficult for me. | SA | A | N | D | SD |
| It is easy for me to become skillful at using WEB based instruction. | SA | A | N | D | SD |
| I find WEB based instruction difficult to use. | SA | A | N | D | SD |
| Using WEB based instruction demands too much time for the benefit it reaps. | SA | A | N | D | SD |
| Using WEB based instruction would not improve my teaching performance. | SA | A | N | D | SD |
| Using WEB based instruction would not increase my productivity. | SA | A | N | D | SD |
| Using WEB based instruction would enhance my effectiveness as a teacher. | SA | A | N | D | SD |
| I would find WEB based instruction useful to use in my class. | SA | A | N | D | SD |
| I intend to increase my use of WEB based instruction in the future. | SA | A | N | D | SD |
| I don't intend to use WEB based instruction now or in the future. | SA | A | N | D | SD |
| I intend to use WEB based instruction for teaching. | SA | A | N | D | SD |

My use of WEB based instruction is

| | | | | | | |
|---|---|---|---|---|---|---|
| Good | ___ | ___ | ___ | ___ | ___ | Bad |
| Harmful | ___ | ___ | ___ | ___ | ___ | Beneficial |
| Pleasant | ___ | ___ | ___ | ___ | ___ | Unpleasant |
| Enjoyable | ___ | ___ | ___ | ___ | ___ | Not enjoyable |
| Unnecessary | ___ | ___ | ___ | ___ | ___ | Essential |
| Required | ___ | ___ | ___ | ___ | ___ | Optional |

Using WEB based instruction is

| | | | | | | |
|---|---|---|---|---|---|---|
| Unlikely | ___ | ___ | ___ | ___ | ___ | Likely |
| Probable | ___ | ___ | ___ | ___ | ___ | Improbable |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| My students think I | Should | ___ | ___ | ___ | ___ | ___ | Should not | Use WEB based instruction. |
| Most of my peers think I | Should | ___ | ___ | ___ | ___ | ___ | Should not | Use WEB based instruction. |

I believe that Using WEB based instruction is

| | | | | | | |
|---|---|---|---|---|---|---|
| Good | ___ | ___ | ___ | ___ | ___ | Bad |
| Harmful | ___ | ___ | ___ | ___ | ___ | Beneficial |
| Undesirable | ___ | ___ | ___ | ___ | ___ | Desirable |

In terms of using WEB based instruction, how much do you want to do what your peers think you should do?

| | | | | | | |
|---|---|---|---|---|---|---|
| Not at all | ___ | ___ | ___ | ___ | ___ | Very much |

In terms of using WEB based instruction, how much do you want to do what your students think you should do?

| | | | | | | |
|---|---|---|---|---|---|---|
| Not at all | ___ | ___ | ___ | ___ | ___ | Very much |

I currently use WEB based instruction:

| | | | | |
|---|---|---|---|---|
| Every day | ____ | Once a month | ____ | |
| Every week | ____ | Not at all | ____ | |
| Twice a month | ____ | | ____ | (fill in) |

**Figure C:** Technology Acceptance Measures

## Designing Strategies for Change

How might TRA, TAM, and similar models guide efforts to promote change in educational practice? Regardless of specific situational adaptations, these reasoned action models remind us that both acceptance and resistance are grounded in "reasonings," and change in behavior must be associated somehow with these underlying reasonings. A model that adequately represents the relationship between the decision to use technology and the underlying attitudinal and normative components can help us to target beliefs and perceptions that make a difference to what faculty actually do. In this section, we consider two pervasive faculty development strategies, using TRA to illuminate the process by which these strategies might affect behavior, and then use the model to generate new strategies that are not so obvious.

### Incentives

One common strategy for encouraging the use of technology is to provide direct incentives for doing so. During summer 1998, the Faculty Development Partnership offered the incentive of a loaded laptop computer to recruit faculty members teaching General Education courses into one-week workshops on new technology and new teaching strategies (http://www.fcii/arizona.edu/gened). These workshops have been wildly successful, drawing many more recruits than can be served and generating rave reviews from faculty (e.g., http://www.fcii.arizona.edu/gened/may_18_participant_comments.htm). Yet the incentive offered is very modest relative to the time commitment required of the faculty members. We should not suppose that incentives work only through direct change in beliefs about outcomes of behavior (that is, by linking the acquisition of some good, like a laptop computer, to the performance of a behavior).

Incentives have complex functions. Besides their potential to directly affect beliefs about the outcomes of behavior, they may also indirectly affect other beliefs by providing direct experiential evidence on issues such as the difficulty of using technology and the impact of technology use on workload. However, incentives serve a more important and often overlooked function in educational institutions: They provide information on what it is the institution and its leaders value. Very small incentives often draw faculty effort out of all proportion to their practical value, in part because these incentives are frequently the only clear clues faculty have for figuring out the institution's current priorities. For this reason, over the past two years our Faculty Development Partnership has

been very explicit in linking any incentive offered to a statement of institutional objectives. The laptop program has been explicitly represented as a form of administrative support for General Education faculty, and our yearly internal grants program has for each of the past two years issued Calls for Proposals that incorporate a specific support agenda (such as building infrastructure for distributed learning—see the current CFP at http://www.facpartner.arizona.edu).

**Training**

A straightforward implication of TAM is that acceptance of technology can be increased by attacking the ease of use. One obvious way to do that is through training, and this has been a mainstay of Faculty Development at Arizona through both the volunteer phase (in which training was organized and offered by the Faculty Development Team in symposia, showcases, and other special events) and the Partnership phase (through which training has been offered mainly as workshops and individual consultation by the Library and the Faculty Center for Instructional Innovation).

Again, however, the relationship between strategy and behavior is complex. Training does often succeed in persuading people of the benefits of new technology, and it also often succeeds in overcoming beliefs about the difficulty of using new technology. As with incentives, however, training also provides normative information as a side benefit. Participants in the laptop program appreciated being introduced to new possibilities and helped with new skills, but they expressed real surprise at the value of interaction with their own peers. Comments by workshop participants are open on the web (http://www.fcii.arizona.edu/gened); a few of the norm-related comments are shown below:

1) I wish this opportunity could be available to all faculty members. The increased sense of community I feel and commitment to our common mission of teaching is amazing.
2) Having the opportunity to work closely with other faculty members from across campus has greatly increased my understanding of how, we as individual instructors, can collectively impact the education of our undergraduate students. As we shared our lessons and talked about writing in each of our courses, the big picture came together for me.
3) Apart from increasing my awareness of the new instructional possibilities technology opens up, the sense of community engendered among the participants was revelatory. The commitment to teaching on this campus is far greater than I and I gather others in the group had suspected.

Neither incentives nor training are designed specifically to take advantage of normative influence. On the contrary, incentives are usually conceptualized as a way to make the outcomes of the behavior more rewarding (leading to a more positive calculation of the behavior's consequences), and training is usually conceptualized as a way to overcome resistance associated with perceived difficulty, i.e., incidental lessons are associated with the information participants get about how the institution or the expert community values behavior. This suggests some less obvious avenues for promoting adoption of technology in education, relaying directly on well-understood structures for peer review.

**Activity Reporting**

In TRA, the powerful influence of what is recognized among children as "peer pressure" is modeled more generally as the subjective norm component. We believe that faculty are much more sensitive to normative influences than is suggested by the TAM, that strategies commonly understood as operating through the attitudinal component are effective partly because of incidental normative information, and that sensitivity to normative influence can be used to develop additional change strategies within educational organizations. Specifically, creation of structures that require or seem to require that faculty pay attention to their own use or non-use of technology establishes technology use as important to the expert community and as subject to normative evaluation.

Arizona has recently undergone comprehensive revision of its Tenure and Promotion guidelines. Use of technology is not explicitly linked to positive or negative decisions. However, the newly adopted reporting formats include sections for reporting of technology use and other forms of instructional innovation (http://w3.arizona.edu/~vprovacf/p&t/section6.html), and the simple occurrence of a reporting opportunity of this kind makes technology use a matter of normative influence. Not only does the reporting formation represent technology use as important to the faculty role, but also, the content reported by any faculty member becomes important normative information for any colleagues who review the dossier. Many faculty interpret the inclusion of

a reporting category of technology as a sign of institutional approval of technology use. TRA and its theoretical spin-offs suggest that one powerful form of support for change is creation of stronger normative beliefs—exploitation of peer pressure. Even without linking of the activity to outcomes, faculty who believe that their peers will be impressed by reported activity are more likely to engage in that activity.

## Conclusion

To ameliorate faculty use of technology, we need better representations of why some adopt technology and why some resist it. This is the purpose of such models as the Theory of Reasoned Action and the Technology Acceptance Model. Working from detailed pictures of the determinants of technology use, our attention is directed to factors that influence intentions and behavior. In particular, these models direct our attention to often overlooked normative influences that may have powerful persuasive effects within educational organizations.

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